

NOTES ON NORTH AMERICAN TREES. III. TILIA. I

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The results of a study of the lindens of the United States carried on for a number of years will be found in these notes. It is based on observations of these trees in the forest and the examination of a large collection of herbarium material gathered in all parts of the country where lindens grow.

To understand a species of *Tilia* properly 4 collections are needed: the first made in early spring to show the unfolding leaves, the second in early summer when the trees are in flower, the third 6 or 8 weeks later when the fruit is mature, and the fourth in winter for the winter buds. Many of these trees grow in regions where summer collecting presents many difficulties and causes much discomfort; the trees do not always flower every year, and the fruit often does not mature or is destroyed in storms before it is ripe. It is not surprising, therefore, that American lindens are poorly represented in the older herbaria and that botanists depending on collections in herbaria have not been able to obtain a comprehensive idea of the representatives of the genus in this country.

Even with abundant material it is difficult to find characters by which the different species and their varieties can be satisfactorily arranged. In most of the large genera of trees many of the species can be distinguished by the bark, but the bark of the American lindens varies so little that it has no value in determining species. The branchlets of some species are stouter than others, but stout and slender branchlets are often found on the same tree. Their color is uniform on some species, but on others varies from yellow or pale brown to red; on some species the branchlets are glabrous and on others they are pubescent, but in some species glabrous and pubescent branchlets are found on the same tree. In a few species a good character is found in the winter buds, but on other species the buds may be glabrous or pubescent. Except in size, there is no constant character in the flowers, and the fruit, although it varies

slightly in size, is always globose, depressed-globose, slightly ovoid, or ellipsoidal, fruits of these different forms occurring in the same species and some of them on the same tree. The shape and size of the leaves vary on different branches of the same tree, but their serration and venation have sometimes specific importance. The only constant and reliable character, however, which I have found for distinguishing the species is in the absence or presence of the hairy covering on the surface of the leaves and in the nature of this covering when it exists, and the following arrangement of the species is based on these characters. The color of the hairs, however, cannot be depended on; on some species the hairs on the lower surface of the leaves are constantly white, but in other species they are brown or white on different trees, and on others they are white on the leaves of lower branches and brown on those of upper branches. When it is possible to make a comparative study of the trees growing together in an arboretum where they can be watched through the year it will probably be found that some of the characters which now seem constant cannot be depended on and that another arrangement of this group will be necessary.

Unfortunately the lindens first known from North America were described in Europe, often from cultivated trees, and the material on which these descriptions were made was insufficient and is often no longer in existence. There is therefore still some uncertainty in regard to the correct names of a few species.

I take this opportunity to express my sincere thanks to Mr. T. G. HARBISON, Professor R. S. COCKS, and Mr. E. J. PALMER, who have patiently and industriously collected *Tilia* material for the Arboretum and made possible these notes.

CONSPECTUS OF THE SPECIES OF THE UNITED STATES

Surface of the leaves glabrous at maturity.

Leaves glabrous or almost glabrous when they unfold, coarsely serrate.

Leaves furnished with conspicuous tufts of axillary hairs, their lower surface light green and lustrous; pedicels glabrous or nearly glabrous

1. *T. glabra*

Leaves usually without tufts of axillary hairs, their lower surface not lustrous; pedicels densely hoary tomentose 2. *T. nuda*

- Leaves hoary tomentose when they unfold.
- Leaves soon glabrous.
- Leaves coarsely serrate with stout teeth, their veinlets conspicuous; branchlets stout, bright red. 3. *T. venulosa*
- Leaves finely serrate with straight or incurved teeth, their veinlets less conspicuous; branchlets slender, pale reddish brown. 4. *T. littoralis*
- Leaves crenately serrate, glaucescent on the lower surface
5. *T. creno-serrata*
- Leaves covered below early in the season with articulate hairs, becoming glabrous or nearly glabrous.
- Leaves thin, coarsely serrate, green or glaucescent on the lower surface, with or without tufts of axillary hairs; summer shoots not pubescent
6. *T. floridana*
- Leaves subcoriaceous, finely serrate, bluish green and lustrous below early in the season; tufts of axillary hairs minute, usually wanting; summer shoots pubescent. 7. *T. Cocksii*
- Surface of the leaves pubescent below during the season.
- Lower surface of the leaves covered with short gray firmly attached pubescence; tufts of axillary hairs not conspicuous. 8. *T. neglecta*
- Lower surface of the leaves covered with articulate easily detached hairs.
- Branchlets without straight hairs.
- Leaves ovate, acuminate, usually obliquely truncate at base, glabrous above, their pubescence brownish or white. 9. *T. caroliniana*
- Leaves oblong-ovate, cordate or obliquely cordate at base, pubescent above early in the season. 10. *T. texana*
- Leaves semiorbicular to broadly ovate, abruptly short-pointed, deeply and usually symmetrically cordate at base. 11. *T. phanera*
- Branchlets covered with straight hairs; leaves ovate, abruptly short-pointed, oblique and truncate at base. 12. *T. lasioclada*
- Surface of the leaves tomentose below during the season with close firmly attached tomentum.
- Tomentum white, gray, or brown; leaves usually glabrous on the upper surface; branchlets and winter buds glabrous (occasionally pubescent in varieties of no. 13).
- Branchlets slender; petioles not more than 4 cm. long; leaves oblong-ovate, acuminate or abruptly pointed, oblique and truncate or cordate at base; tomentum on the leaves of upper branches often brown; flowers 3.5–5 mm. long. 13. *T. heterophylla*
- Branchlets stout; petioles up to 7 cm. in length; leaves oblong-ovate, acuminate, obliquely truncate at base; tomentum always white; flowers 10–12 mm. long. 14. *T. monticola*
- Tomentum pale or brownish; leaves thickly covered above early in the season with fascicled hairs; branchlets tomentose; winter buds pubescent
15. *T. georgiana*

1. *TILIA GLABRA* Vent.—*Tilia americana* var. *a densiflora* V. Engler, Monog. *Tilia*, 137 (in part). 1909; *Tilia americana* var. *densiflora* f. *megalodonta* V. Engler, l.c. 139. 1909; *Tilia americana* var. *densiflora* f. *laxiflora* V. Engler, l.c. 140. 1909.—For the northern lime tree with glabrous leaves the name *Tilia americana* has been adopted in recent years by all authors who have written on American trees. LINNAEUS, however, based his species on the *Tilia floribus nectariis instructis* of KALM, quoting as synonyms of KALM'S species the *Tilia foliis majoribus mucronatis* of CLAYTON and the *Tilia amplissimis glabris foliis, nostrati similis* of PLUKENET Mant. 181. KALM'S specimen is not in the Linnaean Herbarium, and it is impossible to identify it from the description, which applies as well to anyone of the 3 species which KALM may have seen. Indeed both *T. neglecta* and *T. heterophylla Michauxii* are more common in the part of the country which he visited than the tree which recent authors have called *T. americana*, and it is impossible to identify KALM'S plant. CLAYTON'S description cannot be applied to the northern glabrous tree, for it is not known to grow in CLAYTON'S region; and as it is impossible to determine if more than one species was included in LINNAEUS' *T. americana* or, if the name was applied only to one species, what that species was, it seems necessary to give up entirely the name of *T. americana* Linnaeus. This name was taken up by MILLER in the eighth edition of *The Gardener's Dictionary*, but the leaves of MILLER'S *T. americana* are described as "subtus pilosis," and his species is probably the *T. neglecta* of SPACH, which is now known to be an old inhabitant of European gardens. AITON'S description in the *Hortus Kewensis*, "*T. floribus nectario instructis, foliis profundis cordatis argute serratis glabris*," well describes the northern glabrous tree, although he follows LINNAEUS in calling it a native of Virginia and Canada. The *T. caroliniana* of MARSHALL but not of MILLER is probably the northern tree, and his *T. americana* with leaves a little hairy underneath is evidently *T. neglecta*, which is the common species in MARSHALL'S region. If the *T. americana* of LINNAEUS is rejected, it is necessary to determine what name should be adopted for it. The next name used for this tree is *T. glabra* of VENTENAT, published in 1800, and this seems to be the name which should be adopted

for it, as it was by NUTTALL, DECANDOLLE, HOOKER, DARLINGTON, and other authors. In his description VENTENAT speaks of the leaves as "d'abord légèrement pubescent, ensuite parfaitement glabre," which is correct, for although the young leaves are often entirely glabrous they are sometimes furnished for a few days after they unfold with scattered articulate hairs on the upper surface and on the lower surface with soft pale hairs which are most abundant on the midribs and veins.¹

2. **Tilia nuda**, n.sp.—*Tilia pubescens* var. *a Aitonii* V. Engler, Monog. Tilia, 128 (in part). 1909; *Tilia americana* var. *a densiflora* V. Engler, l.c. 137 (insomuch as relates to Houston, Texas). 1909; *Tilia americana* probably of many authors but not of LINNAEUS.—Leaves thin, ovate, abruptly pointed at apex, obliquely truncate or unsymmetrically cordate at base, coarsely serrate with long, slender, straight, or slightly curved, conspicuously glandular teeth; as they unfold, dark red and sparingly pubescent on the midribs and veins, glabrous at the end of a few days, without or very rarely with small axillary tufts, dark green on the upper surface, pale yellow-green on the lower surface, 10–12 cm. long, 7–9 cm. wide; petioles slender, glabrous, 5–6 cm. in length. Flowers 8–10 mm. long, on hoary tomentose pedicels, in broad usually 10- or 12- sometimes 30- or 40-flowered long-branched glabrous corymbs; peduncle glabrous, the free portion 2–3 cm. in length, the bract glabrous, oblong, often slightly falcate, cuneate or rounded at base, rounded at apex, short-stalked, 1–3 cm. wide; sepals acute, rusty tomentose on the outer surface, glabrous on the inner surface; petals oblong-ovate, narrowed at the rounded apex; staminodia oblong-obovate, rounded at the broad apex, style glabrous. Fruit subglobose to depressed-globose, covered with rusty tomentum, 6–7 mm. in diameter.

¹ VENTENAT'S paper on *Tilia* was read in 1799 and published in 1802 in the fourth volume of the *Mémoires de l'Acad. Sci. Paris*. A separate of this paper with the same pagination appeared the same year, but a Spanish translation without the illustrations was published in Madrid in May 1800 with the title *Monografía del género Tilo* in the second volume of the *Anales de Historia Natural*. The correct citation, therefore, of VENTENAT'S American species is *T. glabra* Ventenat in An. Hist. Nat. 2:62. 1800; *T. pubescens* Ventenat in An. Hist. Nat. 2:63. 1800; *T. pubescens* var. *leptophylla* Ventenat in An. Hist. Nat. 2:64. 1800; *T. heterophylla* Ventenat in An. Hist. Nat. 2:65. 1805.

Usually a small tree with pale furrowed or sometimes checkered bark, small spreading branches forming a narrow round-topped head, and slender glabrous orange or red-brown branchlets. Winter buds ovate, obtusely pointed, dull red, glabrous, 4-5 mm. long. Flowers usually in the first week of June before the other species with which it is associated. Fruit ripens in September.

MISSISSIPPI.—Rich woods and river bluffs near Natchez, Adams County, *Miss C. C. Compton*, June 2 and September 24, 1915 (no. 12 type), May and September 1915 (no. 13); Clifton Upper Bluff, *Miss Compton*, May 18, June 2, and September 24, 1915 (no. 2); Kingston Road, near Natchez, *Miss Compton*, August 26, 1915; Fenwick, Adams County, *Miss Compton*, April 17, 1915; bluff of the Mississippi River above Natchez, *C. S. Sargent*, April 8, 1913, April 17, 1915, and April 17, 1916; Woodville, Wilkinson County, *C. S. Sargent*, April 15, 1916; near Jackson, Hinds County, *T. G. Harbison*, May 17, 1915 (no. 63), September 19, 1915 (no. 63A), May 22, 1915, September 18, 1915 (nos. 84, 88A); Bolton, Hinds County, *T. G. Harbison*, May 24, 1915.

ALABAMA.—Hatcher's Creek, Berlin, Dallas County, *R. S. Cocks*, June 6, July 28, 1916 (no. 950).

LOUISIANA.—St. Francisville, West Feliciana Parish, *C. S. Sargent*, April 12, 1916; Lake Charles, Calcasieu Parish, *R. S. Cocks*, May 21, July 7, 1915 (no. 2530), May 21, 1915, *C. S. Sargent*, April 12 and 13, 1915, *E. J. Palmer*, May 16, September 11, 1915 (nos. 7644, 8523).

TEXAS.—White Oak Bayou, Houston, Harris County, *F. Lindheimer*, March 1840 (no. 10779 in *Herb. Missouri Bot. Gard.*), *E. J. Palmer*, May 17, September 15, 1917 (nos. 11397, 12763); Livingston, Polk County, *E. J. Palmer*, October 7, 1914 (nos. 6753, 6755), September 12, 1916 (no. 10696), April 4, September 17 and 19, 1917 (nos. 11467, 12016, 12796, 12797, 12798, 12803); Marshall, Harrison County, *E. J. Palmer*, October 17, 1914 (no. 6852), April 18, 1915 (no. 7277), June 8, 1915 (no. 7912); Larissa, Cherokee County, *B. F. Bush*, October 7, 1909 (no. 5977), *E. J. Palmer*, June 3, September 22, 1915 (nos. 7846, 8622); Liberty, Liberty County, *E. J. Palmer*, May 22, 1915 (no. 7736); San Augustine, San Augustine County, *E. J. Palmer*, September 7, 1916 (no. 10627); College Station, Brazos County, *E. J. Palmer*, April 28, 1917 (no. 11722); Huntsville, Walker County, *E. J. Palmer*, May 26, 1917 (no. 12046).

ARKANSAS.—Fulton, Hempstead County, *B. F. Bush*, April 5, 1909 (no. 5464A); McNab, Hempstead County, *E. J. Palmer*, June 18, 1915 (no. 8056), September 8, 1917 (no. 12674).

On this tree as it grows in the neighborhood of Natchez, where it is common, the bracts of the peduncles vary from 1 cm. up to 3 cm. in width. In *Miss Compton's* no. 12 the bracts are sometimes almost sessile or are borne on stalks of varying length up to 3 cm. At Larissa, Texas, trees growing on sandy moist hillsides are often 25-30 m. high, with trunks 75 cm. in diameter covered with deeply fissured bark. The absence of pubescence from the young leaves and the absence of axillary hairs well distinguish this species, but the absence of

the axillary tufts cannot always be depended on, for occasional trees have been found in Louisiana and Alabama on which some of the leaves are furnished with these tufts (Louisiana, near Alexandria, Rapides Parish, *R. S. Cocks*, June 1905; Wakefield, West Feliciana Parish, *R. S. Cocks*, June 1905. Alabama, near Selma, Dallas County, *R. S. Cocks*, June and July 1914, June 2, July 12, 1915 [no. 784], April 20, July 25, 1916 [nos. 822, 960]).

A form of this tree with leaves more or less pale on the lower surface may be distinguished as

TILIA NUDA var. **glaucescens**, n.var.—Differing from the type in the glaucous lower surface of the leaves.

ALABAMA.—Bluffs of the Alabama River, Berlin, Dallas County, *R. S. Cocks*, June 11, July 20, 1915 (no. 786 type).

LOUISIANA.—Lake Charles, Calcasieu Parish, *R. S. Cocks*, May 21, 1915 (no. 2534); Natchitoches, Natchitoches Parish, *E. J. Palmer*, May 10, June 9, 1915 (nos. 7569, 7923), June 9, 1915 (no. 7923).

OKLAHOMA.—Page, Le Flore County, *E. J. Palmer*, July 27, 1917 (no. 12638).

TEXAS.—Marshall, Harrison County, *E. J. Palmer*, June 8, 1915 (nos. 7909, 7912); San Augustine, San Augustine County, *E. J. Palmer*, June 5, 1915 (no. 7880).

Like the green-leaved type, the trees of this variety differ in the size of the leaves, in the pedunculate bract which on *Palmer's* no. 7923 from Natchitoches is 8 cm. wide, while on his no. 7909 from Marshall it is only 3.5 cm. wide. The number of flowers in a corymb is equally variable. The tomentum on the fruit of *Cock's* no. 786 from Sardis, which is the only fruit of the variety which I have seen, is paler than that on the fruit of the green-leaved form.

TILIA NUDA var. **brevipedunculata**, n.var.—Differing from the type in the serration of its smaller leaves glaucescent below, in the shorter free portion of the peduncles of the inflorescence, and in its broader bract. Leaves ovate, gradually or abruptly narrowed and acuminate at apex, obliquely and unsymmetrically cordate or rounded at base, finely crenately serrate with gland-tipped teeth, smooth and dark yellow-green on the upper surface, pale yellow-green and glaucescent on the lower surface, glabrous, 7–8 cm. long and 5 or 6 cm. wide; petioles slender, glabrous, 2–2.5 cm. in length. Flowers 5 or 6 mm. long, on pubescent pedicels, in compact, mostly 10–20-flowered, sparingly pubescent corymbs; peduncle sparingly pubescent, the free portion only about 1.5 cm. in length, the bract broad and rounded or unsymmetrically cuneate at base, rounded

or acute at apex, nearly sessile or short-stalked, glabrous with the exception of occasional fascicled hairs on the upper side of the midrib, 7-8 cm. long and 3-3.5 cm. wide, much longer than the peduncle; sepals acute, covered on the outer surface with pale pubescence and on the inner surface with soft white hairs; petals oblong-ovate, acuminate, a third longer than the sepals; staminodia obovate, gradually narrowed and cuneate at base, acute at apex. Fruit not seen.

A tree 8-10 m. high, with slender, glabrous, dark red-brown branchlets. Flowers the first week of June.

Flat wet woods subject to overflow, San Augustine, San Augustine County, Texas, *E. J. Palmer*, June 5, 1915 (no. 7889 type).

This tree should perhaps be considered the type of a new species. So little is known of it, however, that in spite of the different serration of the smaller leaves and the remarkably short free portion of the peduncle of the inflorescence and its broader bract, it is perhaps now best considered a variety of *T. nuda*, which is common in eastern Texas.

3. ***Tilia venulosa***, n.sp.—Leaves broadly ovate, abruptly acuminate at apex, cordate or unsymmetrically cordate or obliquely truncate or cordate at base, coarsely serrate, with gland-tipped teeth pointing forward; when they unfold, covered with pale tomentum, soon becoming pubescent and glabrous before the flowers open, dark yellow-green on the upper surface, paler on the lower surface, 10-14 cm. long and broad, with prominent pale yellow midribs slightly villose on the upper side near the base, and 9 or 10 pairs of remote primary veins without axillary tufts and connected by conspicuous cross veinlets; petioles stout, glabrous, 4.5-5 cm. in length. Flowers 8-9 mm. long, on slightly pubescent pedicels, in broad, slender-branched, nearly glabrous corymbs; peduncle stout, glabrous, red, the free portion 2.5-4 cm. in length, the bract nearly sessile, oblong to slightly obovate, gradually narrowed and rounded at base, rounded at apex, glabrous on upper surface, pubescent below along the midrib and veins, 3-4 cm. wide, longer than the peduncle; sepals ovate, acute, pale pubescent on the outer surface, villose on the inner surface and furnished at the base with a tuft of long white hairs, a third shorter than the lanceolate acuminate petals; staminodia oblong-obovate, rounded at apex, about as long as the sepals; stigma slightly villose at base. Fruit sub-

globose, 6–7 mm. in diameter, covered with loose light brown pubescence.

A tree 20–25 m. high, with stout, red, glabrous branchlets. Winter buds ovate, cylindrical, obtusely pointed, dark red, 7–8 mm. in length. Flowers during the first week of July. Fruit ripens the end of September.

Rocky "coves" in rich soil, Hickory Nut Gap, in the Blue Ridge, North Carolina, *W. W. Ashe*, April, May, and October 1916 (distributed as *T. eburnea* Ashe), *T. G. Harbison*, July 5 and September 21, 1917 (no. 2 type for flowers, no. 3 type for fruit); near Saluda, Polk County, North Carolina, *T. G. Harbison*, July 4, 1917 (nos. 1, 2, 4, 5, 7).

TILIA VENULOSA var. **multinervis**, n. var.—Differing from the type in its obliquely truncate, not cordate, leaves with 12 or 13 pairs of more crowded primary veins, ellipsoidal fruit, slender branchlets, and smaller winter buds.

A single tree near Saluda, Polk County, North Carolina, *T. G. Harbison*, July 4 and September 20, 1907 (no. 6 type).

T. venulosa is one of the handsomest of the American lindens as it is one of the most distinct. Its relationship is with *Tilia glabra*, from which it differs in the venation of the more constantly cordate leaves without axillary tufts, tomentose when they unfold, in the bright red peduncles, in the red branchlets, and in the larger red winter buds.

4. ***Tilia littoralis***, n.sp.—Leaves ovate, unsymmetrical and rounded on one side and cuneate on the other, or symmetrical and cuneate or oblique and truncate at base, abruptly short-pointed and acute or acuminate at apex, finely serrate with straight or incurved glandular teeth; when they unfold, covered above with scattered fascicled hairs and tomentose below, soon glabrous, and when the flowers open, thin, yellow-green, paler on the lower than on the upper surface, 8–10 cm. long and 4.5–6 cm. wide, with slender midribs and primary veins and small conspicuous tufts of rusty brown axillary hairs; petioles slender, glabrous, 2.5–3 cm. in length; leaves on young vigorous shoots broadly ovate, truncate or slightly cordate at base, more coarsely serrate, pubescent with fascicled hairs especially on the midribs and veins, 10–12 cm. long and 8–9 cm. wide, their petioles densely pubescent. Flowers 7–8 mm. long, on pale tomentose pedicels, in small, compact, mostly 9–15-flowered, pubescent corymbs; peduncle covered with scattered

fascicled hairs, the free portion 1.5–2.5 cm. long, the bract sessile, gradually narrowed and cuneate at base, rounded at apex, ciliate on the margins, pubescent on the midribs, otherwise glabrous, 8–10 mm. wide, longer or shorter than the peduncle; sepals acuminate, pale pubescent on the outer surface, villose on the inner surface along the margins and at the base with long white hairs; petals acuminate; staminodia oblong-obovate, rounded at apex. Fruit ellipsoidal to depressed-globose, apiculate, covered with pale brown tomentum, 6–7 mm. in diameter.

A tree with slender glabrous branchlets densely coated when they first appear with pale pubescence, soon glabrous, light reddish brown during their first summer, often bright red during their first winter, becoming purple the following year and ultimately light gray-brown. Winter buds ovate, glabrous or puberulous, bright red, about 5 mm. long and 2–3 mm. in diameter.

Shore of Colonel's, formerly Bermuda, Island on Dyke's Creek, an ocean inlet near the mouths of the North Newport and Medway rivers near Dunham, Liberty County, Georgia, *Miss Julia King*, August 1, 1915, *T. G. Harbison*, September 8 and 9, 1916 (nos. 3, 6, 7), June 18, 1917 (no. 15 type).

This species, which I only know from one locality, is distinct in its small leaves, which are often symmetrical and cuneate at base, and are entirely glabrous with the exception of small conspicuous tufts of axillary hairs, in the small pedunculate bract, slender branchlets, and minute winter buds.

TILIA LITTORALIS var. **discolor**, n.var.—Differing from the type in the smaller leaves (7–8 cm. long) glaucous on the lower surface.

A single tree 17 m. high with a trunk 20 cm. in diameter, leaning over a salt water creek, Colonel's Island, with trees of the typical form and "very conspicuous among the other lindens near by on account of its glaucous leaves," *T. G. Harbison*, June 16, 1917 (no. 16 type).

5. ***Tilia creno-serrata***, n.sp.—*Tilia floridana* Sargent, Man. 672 (in part at least) (not Small) *fig. 548*. 1903.—Leaves ovate, abruptly narrowed and acuminate at apex, usually oblique and unsymmetrically cordate or truncate or occasionally symmetrical and cordate at base, crenately serrate, the teeth tipped with minute glands; when they unfold, covered with pale caducous tomentum; at maturity dark green and lustrous above, glabrescent below, glabrous with the exception of minute axillary tufts of rusty hairs, mostly 9–12 cm. long and 7–8 cm. wide; petioles slender, glabrous, about 3 cm. in length. Flowers 7–8 mm. long, on hoary tomentose

pedicels, in compact, mostly 10-18-flowered, tomentose corymbs; peduncle glabrous, the free portion 2.5-4 cm. in length, the bract oblong-obovate, cuneate at base, rounded at apex, short-stalked, glabrous, usually about 2 cm. wide; sepals acute, hoary tomentose on the outer surface, coated with pale tomentum, mixed with long white hairs on the inner surface; petals narrow-acuminate; staminodia oblong-obovate, notched at apex. Fruit ellipsoidal, conspicuously apiculate at apex, rusty tomentose, 8-10 mm. long and 6-8 mm. in diameter.

A tree 8-10 m. high, with a trunk 25-30 cm. in diameter, and slender, glabrous, red-brown branchlets. Winter buds ovoid, acute, dark dull red, glabrous, 4-5 mm. long. Flowers the middle of June. Fruit ripens from the middle to the end of August.

FLORIDA.—Sandy woods, Oviedo, Seminole County (type locality), *T. L. Mead*, May 15, 1887, June 15 and August 29, 1910; Lake Charm, Orange County, *T. L. Mead*, May 15, 1887, June 1910, *T. G. Harbison*, May 28, 1917 (nos. 3, 4, 5, 6); San Mateo, Putnam County, *T. G. Harbison*, June 15 and September 8, 1915 (nos. 3, 3a, 13, 14); Gainesville, Alachua County, *T. G. Harbison*, June 10, September 10, 1915 (nos. 5, 5A); Lake City, Columbia County, *T. G. Harbison*, April 22 and June 17, 1917 (no. 8); Micanopy Junction, Alachua County, *R. M. Harper*, April 14, 1910 (no. 146); Sumner, Levy County, *T. G. Harbison*, June 12, 1915, June 15, 1916, April 25, June 15, September 25, 1917.

GEORGIA.—Albany, Dougherty County, *T. G. Harbison*, June 25, 1915.

Harbison's Gainesville specimens have more coarsely serrate oblong leaves up to 10 cm. in length and are oblique at base. The bract of the peduncle is 3 cm. broad and in the broader corymbs there are 40-50 flowers. The leaves, however, are crenately serrate and quite glabrous with the exception of the small axillary tufts. This is evidently only a vigorous branch. On one of *Harbison's* San Mateo specimens the leaves in shape and serration resemble those of his Gainesville plant and the pedunculate bracts vary from 1 to 2.5 cm. in width. In the other San Mateo specimen the pedunculate bract is only 1 cm. wide. On *Harbison's* Albany specimen the pedunculate bract is only 5 mm. wide. The trees at San Mateo, Sumner, and Gainesville grow in low hummocks in sandy soil and sometimes attain the height of 20 m., with trunks 45 cm. in diameter.

6. *TILIA FLORIDANA* Ashe, Fl. Southern U.S. 761. 1903.—*Tilia pubescens* var. *a Aitonii* f. *glabrata*, Engler, Monog. Tilia, 129 (in part). 1909; *Tilia caroliniana* var. β *floridana*, Engler, l.c. 132. 1909.—The typical form of this species from Jackson County,

Florida, has broadly ovate, coarsely serrate, thin, acuminate leaves cordate or on leading shoots oblique at base, light green above and pale or green and covered early in the season on the under surface with fascicled hairs which soon disappear, so that when the flowers open they are glabrous or almost glabrous; they are often without tufts of hairs in the axils of the veins, or when these occur they are small, but on trees growing west of the Mississippi River they are more conspicuous. The flowers are 5–6 cm. long and are borne on hoary tomentose pedicels in few-flowered, rather compact, pubescent corymbs; in length the pedunculate bract varies from 6 to 13 cm. and in width from 1.2 to 3.5 cm., and the fruit is subglobose and covered with rusty tomentum. It is a tree with slender, glabrous, red-brown or yellow branchlets and small, obtuse, glabrous winter buds.

From western Florida this linden ranges to northern Georgia and to North Carolina, through the Gulf states to Texas, and through Arkansas to eastern Oklahoma and northern Missouri.

NORTH CAROLINA.—Polk County, *W. W. Ashe*, June 1875 (no. 102).

GEORGIA.—Cornelia, Habersham County, *T. G. Harbison*, September 30, 1916 (no. 5); Albany, Dougherty County, *T. G. Harbison*, June 25, 1915 (no. 2); cliffs of the Savannah River above Augusta, Richmond County, *C. S. Sargent*, March 30, 1908, *T. G. Harbison*, April 16, 1916 (no. 7); Shell Bluff, 30 miles below Augusta, *C. S. Sargent*, April 6, 1914.

FLORIDA.—Jackson County, *T. G. Harbison*, September 18 and 19, 1916 (nos. 3, 5, 6, 9, 11); near Mariana, *T. G. Harbison*, April 20, May 26 and 29, and June 29, 1917 (nos. 1, 7, 8, 20, 25, 32); River Junction, Gadsden County, *T. G. Harbison*, September 14, 1915; Sumner, Levy County, *R. M. Harper*, April 26, 1909 (no. 35).

ALABAMA.—Birmingham, Jefferson County, *T. G. Harbison*, October 15, 1914, October 2, 1916, April 15 and May 18, 1917, April 4, 1918 (no. 24), June 24 and 28, 1918 (nos. 34, 35, 37, 40, 41, 42); Choctaw County, *C. Mohr*, August 20, 1880 (no. 55); Blount County, *T. G. Harbison*, October 13, 1906, September 23, 1915; Berlin, Dallas County, *R. S. Cocks*, June 25 and July 28, 1916 (nos. 950, 956).

MISSISSIPPI.—Yazoo City, Yazoo County, *T. G. Harbison*, May 1 and 30, 1915; near Natchez, Adams County, *C. S. Sargent*, April 1913, 1915, and 1916, *Miss C. C. Compton*, April, May, and September 1915; Jackson, Hinds County, *T. G. Harbison*, May 17, 24, and September 18, 1915 (nos. 64, 64a, 78, 78a, 113), *C. S. Sargent*, April 18, 1916; Bolton, Hinds County, *T. G. Harbison*, May 24, 1915.

LOUISIANA.—West Feliciana Parish, *R. S. Cocks*, May 15 and June 12, 1915 (nos. 2528, 2540); near Laurel Hill, *C. S. Sargent*, April 12, 1916; Welch, Beauregard Parish, *E. J. Palmer*, May 17, 1915 (no. 7673); near Opelousas, St. Landry Parish, *C. S. Sargent*, March 17, 1900, April 3, 1913; east of Opelousas, *R. S. Cocks*, April 3 and August 10, 1916 (nos. 4010, 4020); Lake Charles, Calcasieu Parish, *R. S. Cocks*, October 1914, May 21, 1915 (no. 2536), April 3, 1916 (nos. 2530, 4014), *E. J. Palmer*, May 19 and September 11, 1915 (nos. 7695, 8510, 8511); Winnfield quarries, Winn Parish, *R. S. Cocks*, April 18, 1917 (no. 4076); Shreveport, Caddo Parish, *R. S. Cocks*, June 1908 (no. 10), *E. J. Palmer*, April 18 and September 6, 1916 (nos. 9479, 10608); sandy hills, Chopin, Natchitoches Parish, *E. J. Palmer*, April 21 and June 12, 1915 (nos. 7342, 7970); sandy upland woods, Natchitoches Parish, *E. J. Palmer*, May 10, 1915 (no. 7574); banks of Red River, Grand Ecore, April 15, 1916 (no. 9449).

TEXAS.—Marshall, Harrison County, *B. F. Bush*, October 8, 1901 (no. 993), *E. J. Palmer*, April 18, June 8, September 26, 1915 (nos. 7279, 8675); Houston, Harris County, *E. J. Palmer*, May 17, September 15, 1915 (nos. 11937, 12763); Livingston, Polk County, *E. J. Palmer*, April 9, 1914 (no. 5151), May 23, 1917 (no. 12003); Pledger, Matagorda County, *E. J. Palmer*, May 8, 1916; Larissa, Cherokee County, *E. J. Palmer*, June 3, September 22, 1915 (nos. 7844, 8619), April 7, September 14 and 16, 1916 (nos. 9373, 9377, 9382, 9387, 10706, 10707, 10709); Groesbeck, Limestone County, *E. J. Palmer*, June 1, 1915 (no. 7833); San Augustine, San Augustine County, *E. J. Palmer*, June 5, 1915 (nos. 7882, 7883), April 19, September 8, 1916 (nos. 9487, 9491, 9498, 10635, 10637), September 9, 10, 1917 (nos. 10730, 12689, 12690); Palestine, Anderson County, *E. J. Palmer*, September 15, 1916, May 29, 1917 (nos. 12085, 12086); Dayton, Liberty County, *E. J. Palmer*, April 3, May 21, 1917 (nos. 11461, 11977); Huntsville, Walker County, *E. J. Palmer*, May 24, 1917 (no. 12024); rocky banks of the Blanco River, Blanco County, April 4, June 5, September 25, 1917 (nos. 11577, 11578, 11579, 11580, 12160, 12164, 12166, 12167, 12171, 12860, 12861, 12866), April 5, 1918 (nos. 13281, 13286); near Boerne, Kendall County, *S. H. Hastings*, June 23, 1911 (no. 201), *E. J. Palmer*, March 27, May 19 and 26, September 27, 1916 (nos. 9265, 9812, 9813, 9823, 9824, 9876, 9879, 9889, 10823, 10824), April 6 and 19, June 13 and 16, September 28–30, 1917 (nos. 11473, 11477, 11485, 11490, 11493, 11594, 11597, 11603, 12239, 12240, 12241, 12243, 12278, 12890, 12897, 12898, 12905); base of the bluff of the Guadalupe River, Kerrville, Kerr County, *E. J. Palmer*, April 8, May 27, June 9, 1917 (nos. 9930, 11503, 12212, 12215, 12216), May 16, 1918 (no. 13269); Lacey's Ranch, near Kerrville, *E. J. Palmer*, May 31, June 6 and 10, July 3, 1916 (nos. 9957, 10032, 12221), April 8, 1917 (no. 11495); rocky banks, upper Seco Creek, Bandera County, *E. J. Palmer*, May 18, 1916 (no. 10236); rocky banks of the Frio River, Concan, Uvalde County, June 14, 1916 (nos. 10183, 10200), April 13, 1917 (nos. 11541, 11542).

ARKANSAS.—Fulton, Hempstead County, *B. F. Bush*, April 11, 1905 (no. 2290), April 28, May 19, June 6 and 10, October 4, 1909 (nos. 5543, 5647B, 5780A, 5814, 5815, 5926), *J. H. Kellogg*, June 20, 1910, *E. J. Palmer*, April 22 and 23, October 19, 1914 (nos. 5355, 5365, 6876), April 10, June 17, 1915 (nos. 7179, 8044), July 18, 1916 (no. 10513); McNab, Hempstead County, *E. J. Palmer*, April 12, June 18, 1915 (nos. 7187, 7204, 8054), April 8, 1916 (no. 9401); Brentwood, Washington County, *E. J. Palmer*, July 7, 1914 (no. 8214); Gum Springs, Clark County, *E. J. Palmer*, June 20, 1915 (no. 8073), July 21, 1916 (nos. 10539, 10543, 10544); Piney, Johnson County, *E. J. Palmer*, June 30, 1915 (no. 8161); Ashdown, Little River County, *E. J. Palmer*, July 21, 1915 (no. 8367); Fort Lynn, Miller County, *E. J. Palmer*, July 19, 1916 (no. 10529); Van Buren, Crawford County, *G. M. Brown*, June 1908; Rogers, Benton County, *B. H. Slavin*, April 30, 1910; Cotter, Marion County, *E. J. Palmer*, September 1, 1915 (no. 804).

OKLAHOMA.—Lenapah, Nowata County, *G. W. Stevens*, August 19, 1913 (no. 2171); near Page, Le Flore County, *G. W. Stevens*, September 8, 1913 (no. 2669), *E. J. Palmer*, October 28, 1915 (no. 9033); Poteau, Le Flore County, *E. J. Palmer*, July 13, 1915 (no. 8281); Fort Towson, Choctaw County, *E. J. Palmer*, July 10, 1915 (no. 8307); Idabelle, McCurtain County, *E. J. Palmer*, July 22, 1915 (no. 8382); Antlers, Pushmataha County, *E. J. Palmer*, July 17, 1915 (no. 8339).

MISSOURI.—Hannibal, Marion County, *J. Davis*, June 5, 1914; Clarksville, Pike County, *J. Davis*, June 16, 1914; Allenton, St. Louis County, *C. S. Sargent*, April 4, 1909; Siebert's Mill, *E. J. Palmer*, August 5, 1916 (no. 10572); Williamsville, Wayne County, *E. J. Palmer*, June 29, 1914 (no. 6126); near Mansfield, Douglas County, *E. J. Palmer*, July 10, 1914 (no. 6254); Elk Springs, McDonald County, *E. J. Palmer*, May 3, 1914 (no. 5473); Galena, Stone County, *E. J. Palmer*, May 20, 1914 (no. 5648), July 25, 1916 (nos. 10561, 10566); Noel, McDonald County, *B. F. Bush*, April 25, October 8, 1909 (nos. 5530, 5983); Eagle Rock, Barry County, *B. F. Bush*, August 10, 1905 (no. 3211), *E. J. Palmer*, July 17, 1914 (no. 6311).

MEXICO.—Coahuila, *Ed. Palmer*, 1880 (no. 118 in Herb. U.S. Nat. Mus.); mountains near Monclova, *Ed. Palmer*, August 19, 1880 (no. 118 in Herb. U.S. Nat. Mus.).

The specimen collected by *Edward Palmer* on the mountains west of Monclova in the state of Coahuila August 19, 1880 (no. 118), and distributed as *T. mexicana* Bentham cannot be distinguished from specimens from western Texas which I have referred to *T. floridana*. *T. mexicana* of BENTHAM (Pl. Hartweg. 35. 1839) is said to have come from the neighborhood of Anganguio in the state of Michoacan in southern Mexico and not to be the same as the earlier *T. mexicana* Schlechtendal (Linnaea 11:37. 1837) collected near Chiconguiaco in the state of Hidalgo, and by HEMSLEY doubtfully referred to *T. americana* Linnaeus. *T. mexicana* Bentham is a nomen nudum.

A variety of this tree which differs only in its glabrous corymbs and puberulous peduncles may be distinguished as

TILIA FLORIDANA var. **australis**, n.var.—*Tilia australis* Small, Flora Southern U.S. 761. 1903; *Tilia pubescens* var. *a Aitonii* f. *glabrata* V. Engler, Monog. Tilia, 129 (in part). 1909.

This variety I have seen only from Blount County, Alabama.

Another linden of this group had best perhaps be considered as a variety of *T. floridana*, distinguished in the shape of its leaves and in their more prominent tufts of axillary hairs. I suggest for the name of this variety

TILIA FLORIDANA var. **oblongifolia**, n.var.—Distinguished from the type by its ovate-oblong leaves with more conspicuous tufts of axillary hairs. Leaves thin, ovate-oblong, long-pointed and acuminate at apex, unsymmetrical and rounded on one side and broadly cuneate on the other, or very oblique and truncate at base, coarsely serrate with apiculate teeth, dark green, smooth and lustrous on the upper surface, glaucescent or pale green on the lower surface, and furnished with usually large conspicuous tufts of axillary hairs, 8–10 cm. long and 6–8 cm. wide; petioles slender, glabrous, 3–4 cm. in length. Flowers 5–6 mm. long, on slender, hoary tomentose pedicels, in wide, thin-branched, stellate-pubescent, mostly 15–20-flowered corymbs; peduncle slender, glabrous, the free portion 2–2.5 cm. long, the bract acuminate at base, rounded at apex, raised on a slender stem, 1.3–1.5 cm. wide, much longer than the peduncle; sepals acuminate, hoary tomentose on the outer surface, villose at the base and along the margins on the inner surface; petals narrow, acuminate, nearly twice as long as the sepals; staminodia narrow spathulate, rounded and erose at apex, about as long as the petals; stigma slightly villose at base. Fruit on slender pubescent pedicels, ellipsoidal, covered with pale brownish tomentum, 6–7 mm. long and 5–6 mm. wide.

A tree with slender, glabrous, pale reddish brown branchlets, becoming dark red-brown in their second year. Winter buds obtuse, glabrous, 4–5 mm. in length. Flowers early in June. Fruit ripens at the end of July.

FLORIDA.—Blue Springs, Jackson County, *T. G. Harbison*, September 18, 1916; River Junction, Gadsden County, *T. G. Harbison*, April 25, 1914 (no. 1478), June 7, 1915 (no. 26); Tallahassee, Leon County, September 12, 1915 (no. 2a); San Mateo, Putnam County, *T. G. Harbison*, June 15, 1915 (no. 2).

ALABAMA.—Bluffs of the Alabama River, near Berlin, Dallas County, R. S. Cocks, June 5 and July 25, 1915 (no. 788 type), April and June 1916 (nos. 820, 832, 834, 952, 954, 958), June 3 and 31, 1917 (nos. 1200, 1202, 1204), C. S. Sargent, April 19, 1915.

MISSISSIPPI.—Edwards, Hinds County, T. G. Harbison, May 18, 1915 (no. 15); near Jackson, Rankin County, T. G. Harbison, May 20, 1915 (no. 76); Natchez, Adams County, C. S. Sargent, April 17, 1915.

LOUISIANA.—Laurel Hill, West Feliciana Parish, R. S. Cocks, March 1910; Avery Island, Iberia Parish, R. S. Cocks, May 29 and July 28, 1916 (nos. 4042, 4052); sandy woods, Natchitoches, Natchitoches Parish, E. J. Palmer, June 11 and September 27, 1915 (nos. 7956, 8699), April 13 and 14, 1916 (nos. 9416, 9437), June 11 and September 25, 1915 (nos. 7956, 8437, 9416), April 1916, Grand Ecore, May 5, 1915 (no. 7523); Chestnut, E. J. Palmer, April 17, 1916 (no. 9462).

ARKANSAS.—Fulton, Hempstead County, B. F. Bush, April 11, 1905 (no. 7534 in Herb. Mo. Bot. Gard.); Benton, Saline County, E. J. Palmer, June 24 and September 3 and 6, 1915 (nos. 2128, 8129, 8131, 8447, 8479), July 22, 1916 (nos. 10546, 10547, 10548, 10552).

TEXAS.—Marshall, Harris County, E. J. Palmer, April 18, June 8 and September 26, 1915 (nos. 7278, 7910, 7913, 8674); Palestine, Anderson County, E. J. Palmer, May 29, 1917 (no. 12086); Livingston, Polk County, E. J. Palmer, April 3 and May 23, 1917 (nos. 11468, 12003, 12004, 12014).

In *Tilia* a fairly constant specific character can usually be found in the absence or presence of the tufts of hairs in the axils of the leaves, but in *T. floridana* they are usually small and sometimes wanting in what is here considered the typical form of the species from western Louisiana; but westward, especially in Texas and Arkansas, they are usually present and sometimes conspicuous, as they are generally on the leaves of the var. *oblongifolia*, and it is only by the narrower more elongated leaves that this variety can be distinguished. The leaves of *T. floridana* have been described as glaucous on the lower surface, but this is not a constant character, as on the same branch leaves glaucescent and green below often occur. A variety of this species with leaves covered below with a silvery white bloom may be distinguished as

TILIA FLORIDANA var. **hypoleuca**, n. var.

ARKANSAS.—At the foot of a high bluff growing on the rocky margin of White River or on talus sloping to the foot of the bluff in rich soil across the river from Cotter, Marion County, E. J. Palmer, June 12, 1914 (no. 5943 type), July 24, 1916 (nos. 10555, 10559).

MISSOURI.—Galena, Stone County, E. J. Palmer, October 10, 1913, July 25, 1916 (nos. 4616, 10565); Branson, Taney County, E. J. Palmer, June 8, 1914 (no. 5896).

The unusual whiteness of the under surface of some of the leaves of this variety is due to a thick bloom. When this is rubbed off, the surface left is pale green. This bloom appears to be most common on leaves near the ends of branches and is often entirely wanting from those lower down on the branches and from the leaves of young vigorous shoots.

7. ***Tilia Cocksii***, n.sp.—Leaves ovate, abruptly acuminate at apex, very oblique at the truncate or rounded base, dentate with small, remote glandular apiculate teeth; when they unfold covered with loose floccose pubescence, nearly glabrous when fully grown early in April; when the flowers open, dark green, and lustrous on the upper surface, pale blue-green and lustrous below, and at mid-summer when the fruit ripens, subcoriaceous, dark green and lustrous on the upper surface, paler on the lower surface with slender primary veins without or occasionally with minute axillary tufts, and connected by conspicuous straight or curved veinlets, 9–10 cm. long and 6–7 cm. wide; petioles slender, glabrous, 1.5–2.5 cm. in length; leaves on leading summer branchlets sometimes obliquely cordate, more coarsely serrate, covered on the upper surface with short fascicled hairs, and floccose-pubescent on the lower surface, 10–13 cm. long, 10–12 cm. wide, their petioles puberulous. Flowers 6–7 mm. long, on tomentose pedicels, in compact pubescent many-flowered corymbs; peduncle slender, glabrous, the free portion only 1.5–2 cm. in length, the bract oblong, occasionally slightly obovate, rounded at the ends and sessile, hoary tomentose on the under surface and pubescent on the upper surface when it first appears, and when the flowers open puberulous below and glabrous above, 1.2–1.5 cm. in width and much longer than the peduncle; sepals ovate, acuminate, pale pubescent on the outer surface, villose at the base on the inner surface, a third shorter than the lanceolate acuminate petals; staminodia oblong-obovate, rounded at apex, about half the length of the petals; style glabrous. Fruit globose to depressed-globose, covered with loose brown tomentum, 6–7 mm. in diameter.

A small tree with slender, dull red, glabrous branchlets, the leading branchlets in summer more or less pubescent. Winter buds ovate, acute, dull red, glabrous or pubescent on leading shoots, 5–6 mm. long. Flowers the middle of May. Fruit ripens the middle of July.

Bank of the Calcasieu River, West Lake Charles, Calcasieu Parish, Louisiana, *Sargent* and *Cocks*, March 23, 1917, *R. S. Cocks*, May 15 and July 12, 1918 (no. 4922 type for flowers, 4949 type for fruit); low woods, Lake Charles, Calcasieu Parish, *C. S. Sargent*, March 26, 1911, April 12 and 13, 1915.

From other American lindens *T. Cocksii* differs in the thicker dark green lustrous leaves, in the peculiar bluish color of their lower surface in early spring, and in the pubescence during the summer on the leaves and branchlets of leading shoots in a species which, except when the leaves unfold and the inflorescence first appears in early spring, is otherwise glabrous. It is most closely related to *T. floridana*, from which it differs in the texture, color, and venation of the more finely serrate leaves, in the more compact inflorescence, and in the much shorter free portion of the peduncle. I take much pleasure in associating with this handsome tree the name of Professor REGINALD WOODHOUSE SOMERS COCKS, professor of botany in Tulane University and for many years my companion in annual journeys of exploration through the forests of Louisiana.

ARNOLD ARBORETUM
JAMAICA PLAIN, MASS.